

# **KANSAS-LOWER REPUBLICAN BASIN TOTAL MAXIMUM DAILY LOAD**

## **Waterbody: Mill Creek Watershed**

### **Water Quality Impairment: Nutrients and Oxygen Demand Impact on Aquatic Life**

#### **1. INTRODUCTION AND PROBLEM IDENTIFICATION**

**Subbasin:** Lower Kansas

**HUC 8:** 10270104

**Waterbody:** Mill Creek Watershed

**HUC 11:** 170

**County:** Johnson

**Drainage Area:** 70.8 miles<sup>2</sup>

**Main Stem Segment:** 39, starting at confluence of Kansas River, headwaters in Johnson County near Olathe

**Designated Uses:** Expected Aquatic Life Support.

**1998 303d Listing:** Table 2—Stream Segments Identified by Biological Monitoring

**Impaired Use:** Expected Aquatic Life Support for Segment 39

**Water Quality Standard:** Nutrients--Narrative: The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life. (KAR 28-16-28e(c)(2)(B)).

#### **2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT**

**Level of Support for Designated Use under 303d:** Not Supporting for Aquatic Life

**Monitoring Sites:** Station 251 near Shawnee

**Period of Record Used:** Stream Chemistry: 1985–1998  
Biological Monitoring: 1993--1996

**Flow Record:** Calculated from Blue River near Stanley (USGS Station 06893080; Recorded Daily Data 1974 - 1997) by proportional drainage

**Current Condition:**

Parameter	Historical Average (1993 - 1996 for biological data)
Macroinvertebrate Biotic Index (MBI)	5.42 (4.56 - 6.13)
% Ephemeroptera, Plecoptera, and Trichoptera (EPT) Taxa	14.14 (8.57 - 20.00)
Biochemical Oxygen Demand (BOD)	2.91 mg/L (0.01 - 7.6 mg/L)
Phosphorus	1686 ug/L (160 - 5,480 ug/L)
Nitrate	3803 ug/L (810 - 19,070 ug/L)

Three main parameters (MBI, %EPT, and BOD) were analyzed to address the nutrient/ oxygen demand impairment. The Macroinvertebrate Biotic Index rates the nutrient and oxygen demanding pollution tolerance of large taxonomic groups (order and family). Higher values indicate greater pollution tolerances. Along with the number of individuals within a rated group, a single index value is computed which characterizes the overall tolerance of the community. The higher the index value the more tolerant the community is of organic pollution exerting oxygen demands in the stream setting. Index values greater than 5.4 are indicative of non-support of the aquatic life use; values between 4.51 and 5.39 are indicative of partial support and values at or below 4.5 indicate full support of the aquatic life use.

The EPT index is the proportion of aquatic taxa present within a stream belonging to pollution intolerant orders; Ephemeroptera, Plecoptera and Trichoptera (mayflies, stoneflies and caddisflies). Higher percentages of total taxa comprising these three groups indicate less pollutant stress and better water quality.

In this stream segment, the MBI indicates that aquatic life is not supported (MBI greater than 5.40). All of the surveys resulted in MBI values over 4.5. Average MBI under non-support conditions was 4.91; average MBI above non-support conditions was 5.93. When aquatic life is not supported, the percent EPT taxa range from 8.6 - 16.0% (12.2% average). The historical average of BOD is close to normal background levels (3 - 4 mg/L).

Phosphorus and nitrate were graphed against flow for the time period between 1986 and 1998. The nutrient concentrations decreased with increased flows. This suggests that phosphorus and nitrate are being diluted. Overall, the average concentration of nutrients in the Mill Creek watershed tends to be extremely high (1686  $\mu\text{g/L}$  phosphorus and 3803  $\mu\text{g/L}$  nitrate).

**Desired Endpoint for Mill Creek for 2004 - 2008**

The use of biological indices allows assessment of the cumulative impacts of dynamic water quality on aquatic communities present within the stream. As such, these index values serve as a baseline of biological health of the stream. Sampling occurs during open water season (April to November) within the aquatic stage of the life cycle of the macroinvertebrates. As such there is no described seasonal variation of the desired endpoint of this TMDL. The endpoint would be average MBI values of 4.5 or less over 2004-2008.

Achievement of this endpoint would be indicative of full support of the aquatic life use in the stream reach, therefore the narrative water quality standard pertaining to nutrients would be attained.

### **3. SOURCE INVENTORY AND ASSESSMENT**

**Land Use:** Urban fertilizer applications are a major contributing factor to the water quality impairment. Population projections for Johnson County to the year 2020 indicate significant (65%) growth. (There are 578 to 1729 people per square mile in the county, and 24 percent of the watershed is urban). With the rising populations, the acreage devoted to suburban homes and the residential fertilizer applications will increase. Fertilizer will continue to be applied to golf courses and business grounds as well. 20,757 tons of fertilizer were purchased in Johnson County in 1998. Twelve percent of Johnson County lies within the watershed. Assuming an even distribution, up to 2,491 tons of fertilizer were bought and used in the watershed.

A significant portion of the 2,491 tons of fertilizer are used for agricultural purposes. 7,936 acres of cropland are located within the watershed.

**Contributing Runoff:** The watershed has an average soil permeability of 0.8 inches/hour according to NRCS STATSGO data base. Runoff would be produced under storms ranging in duration from one to six hours, having a recurrence interval of five, ten or twenty five years. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. Generally, 29.8 percent of the watershed would generate runoff under dryer conditions or smaller storms. Moderate or wet conditions or larger storms would see runoff contributed from 65.0 to 93.4 percent of the watershed.

**NPDES:** There is currently one NPDES permitted wastewater discharger located within the watershed. The Olathe Main Creek plant is located in the upper watershed. It is a trickling filter plant and uses ultraviolet treatment to disinfect its effluent. Many smaller treatment plants have been replaced by the regional treatment plant on the lower reach of Mill Creek. That plant, located in the lower portion of the watershed, came on line in 1995, and discharges directly to the Kansas River.

**Background Levels:** Fifteen percent of the land in the watershed is wooded. Leaf litter falls into the streams and decomposes increasing the biochemical oxygen demand. Geological formations contain small amounts of phosphorus (up to 0.5% of total weight), and may contribute to phosphorus loads.

### **4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY**

There is an indirect, yet un-quantified relation between nutrient loading and biological integrity. Decreased loads should result in aquatic communities, indicative of improved water quality. The characteristics of biological data to integrate the impacts of the entire watershed on the aquatic community defies allocation of specific loads between point and non-point sources. The

relative presence of point and non-point activities has to be used to assess the relative contributions and responsibilities for nutrient load reduction in the watershed. Therefore, allocations are made for this TMDL in a general sense to direct appropriate action, following in the belief that qualitative reduction in nutrient loads will yield improved MBI values. More detailed allocations will be made in 2004 based on additional source assessment and establishment of appropriate numerical nutrient criteria.

**Point Sources:** The nine municipal facilities rely on lagoon systems for wastewater detention and long holding times to minimize the release of nutrients to receiving streams. Ongoing inspections and monitoring of the lagoons will be made to ascertain the contributions have been made by these sources into the stream. At this point, the Wasteload Allocation will be a reduction of BOD loadings from point sources such that monthly average BOD concentrations are maintained below 18 mg/l, leading to instream concentrations of DO remaining above 5 mg/l below 35 cfs. The sporadic occurrence of partial support conditions, indicated by MBI values over 4.5, seems to indicate a lack of consistent loading from the upper drainage.

**Non-Point Sources:** Given the runoff characteristics of the watershed, overland runoff can easily carry phosphorus and nitrates from the watershed into the streams. The fluctuating nature of the MBI values indicates that nutrient impairment waxes and wanes over time, hinting that loadings are variable. As such, non-point sources are implicated as a primary source of these loadings. There are variety of sources contributing nutrient loads to the stream. Additional assessment is necessary to quantify those contributions. At this point, the Load Allocation will be a reduction of nutrient loadings such that average phosphorus concentrations are below 100 ppb in stream and nitrate concentrations average below 200 ppb.

**Defined Margin of Safety:** Given the variable nature of the MBI values seen on this stream, additional biological measures are necessary to assure indications of good aquatic community health. Therefore, the defined Margin of Safety for this TMDL will be a proportion of EPT individuals making up at least 55% of the sample population when MBI values are 4.5 or lower. This will ensure that the majority of aquatic macroinvertebrate population is composed of pollution intolerant taxa.

**State Water Plan Implementation Priority:** Because this TMDL needs additional source assessment and definition of the relationship between aquatic community response and nutrient loading and because numeric nutrient criteria will be developed over the next five years, this TMDL will be a Medium Priority for implementation.

**Unified Watershed Assessment Priority Ranking:** This watershed lies within the Lower Kansas Subbasin (HUC 8: 10270104) with a priority ranking of 1 (Highest Priority for restoration work).

**Priority HUC 11s and Stream Segments:** Since it flows directly into the Kansas River, the main stem segment (HUC 170) should be the priority focus of implementation.

## **5. IMPLEMENTATION**

### **Desired Implementation Activities**

1. Implement soil sampling to recommend appropriate fertilizer applications on cropland
2. Maintain conservation tillage and contour farming to minimize cropland erosion.
3. Install grass buffer strips along streams.
4. Reduce activities within riparian areas
5. Implement nutrient management plans to manage manure application to land
6. Monitor wastewater discharges for excessive phosphorus loadings

### **Implementation Programs Guidance**

#### **NPDES - KDHE**

- a. Ensure proper permitting and operations of municipal wastewater systems to limit nutrient and BOD discharges.

#### **Non-Point Source Pollution Technical Assistance - KDHE**

- a. Support Section 319 demonstration projects for reduction of sediment runoff from agricultural activities as well as nutrient management.
- b. Provide technical assistance on practices geared to establishment of vegetative buffer strips.
- c. Provide technical assistance on nutrient management in vicinity of streams.

#### **Local Environmental Protection Program - KDHE**

- a. Support inspection of on-site wastewater systems to minimize nutrient loadings

#### **Water Resource Cost Share Program - SCC**

- a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands.

#### **Non-Point Source Pollution Control Program - SCC**

- a. Provide sediment control practices to minimize erosion and sediment and nutrient transport

#### **Riparian Protection Program - SCC**

- a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.
- b. Develop riparian restoration projects
- c. Promote wetland construction to assimilate nutrient loadings

#### **Buffer Initiative Program - SCC**

- a. Install grass buffer strips near streams.
- b. Leverage Conservation Reserve Enhancement Program to hold riparian land out of production.

### **Extension Outreach and Technical Assistance - Kansas State University**

- a. Educate agricultural producers on sediment, nutrient and pasture management
- b. Provide technical assistance on buffer strip design and minimizing cropland runoff
- c. Encourage annual soil testing to determine capacity of field to hold phosphorus

**Timeframe for Implementation:** Management practices necessary to implement this TMDL beyond the initial emphasis should be deferred until 2004, pending additional source assessment and evaluation of biological data collected over 2000-2004.

**Targeted Participants:** Primary participants for implementation will be agricultural producers operating within the drainages of the priority subwatersheds. Initial work in 2000 should include local assessments by conservation district personnel and county extension agents to locate within one mile of the streams:

1. Total rowcrop acreage
2. Cultivation alongside stream
3. Fields with manure applications
4. On-site wastewater discharges to stream

Some inventory of local needs should be conducted in 2000 to identify such activities. Such an inventory would be done by local program managers with appropriate assistance by commodity representatives and state program staff in order to direct state assistance programs to the principal activities influencing the quality of the streams in the watershed during the implementation period of this TMDL.

**Milestone for 2004:** The year 2004 marks the mid-point of the ten year implementation window for the watershed. At that point in time, adequate source assessment should be complete which allows an allocation of resources to responsible activities contributing to the nutrient problem. Additionally, numeric nutrient criteria should be established by 2004 and sampled data from Mill Creek should indicate evidence of reduced nutrient levels relative to the conditions seen over 1986-1998.

**Delivery Agents:** The primary delivery agents for program participation will be the conservation districts for programs of the State Conservation Commission and the Natural Resources Conservation Service. Producer outreach and awareness will be delivered by Kansas State Extension and agricultural interest groups such as Kansas Farm Bureau and Kansas Livestock Association and grain crop associations. On-site waste system inspections will be performed by Local Environmental Protection Program personnel for Johnson county.

### **Reasonable Assurances:**

**Authorities:** The following authorities may be used to direct activities in the watershed to reduce pollution.

1. K.S.A. 65-164 and 165 empowers the Secretary of KDHE to regulate the discharge of sewage into the waters of the state.
2. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.
3. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.
4. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control non-point source pollution.
5. K.S.A. 82a-901, et seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.
6. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*.
7. The *Kansas Water Plan* and the Kansas-Lower Republican Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

**Funding:** The State Water Plan Fund, annually generates \$16-18 million and is the primary funding mechanism for implementing water quality protection and pollution reduction activities in the state through the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watersheds and water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This watershed and its TMDL is a **Medium Priority** consideration.

**Effectiveness:** Nutrient control has been proven effective through conservation tillage, contour farming and use of grass waterways and buffer strips as well as runoff control around animal feeding operations. The key to success will be widespread utilization of conservation farming and waste management within the watersheds cited in this TMDL.

Should participation significantly lag below expectations over the next five years or monitoring indicates lack of progress in improving water quality conditions from those seen over 1990-1998, the state may employ more stringent conditions on agricultural producers in the watershed through establishment of a Critical Water Quality Management Area in order to meet the desired endpoints expressed in this TMDL.

## **6. MONITORING**

KDHE will continue to collect seasonal biological samples from Mill Creek for three years over 2000 - 2004 and an additional three years over 2004-2008 to evaluate achievement of the desired endpoint. As numeric nutrient criteria become established, routine sampling at the Shawnee station for nutrients should be evaluated over 2000-2008. Periodic monitoring of nutrient content of wastewater discharged from treatment systems will be expected under reissued NPDES and state permits.

Additional source assessment needs to be conducted and local program management needs to identify its targeted participants of state assistance programs for implementing this TMDL. This information should be collected in 2000-2004 in order to support appropriate implementation projects.

## **7. FEEDBACK**

**Public Meetings:** Public meetings to discuss TMDLs in the KLR Basin were held March 10, 1999 in Topeka, April 27 in Lawrence and April 29 in Manhattan. An active Internet Web site was established at <http://www.kdhe.state.ks.us/tmdl/> to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Kansas-Lower Republican Basin.

**Public Hearing:** A Public Hearing on the TMDLs of the Kansas-Lower Republican Basin was held in Topeka on June 3, 1999.

**Basin Advisory Committee:** The Kansas-Lower Republican Basin Advisory Committee met to discuss the TMDLs in the basin on December 3, 1998; January 14, 1999; February 18, 1999; March 10, 1999; May 20, 1999 and June 3, 1999.

**Discussion with Interest Groups:** Meetings to discuss TMDLs with interest groups include:  
Agriculture: November 10, 1998; December 18, 1998; February 10, 1999; April 10, 1999, May 4, 1999, June 8, 1999 and June 18, 1999.  
Municipal: November 12, 1998, January 25, 1999; March 1, 1999; May 10, 1999 and June 16, 1999.  
Environmental: November 3, 1998; December 16, 1998; February 13, 1999; March 15, 1999, April 7, 1999 and May 3, 1999.  
Conservation Districts: March 16-18, 24-25, 1999



**Milestone Evaluation:** In 2004, evaluation will be made as to the degree of implementation which has occurred within the drainage and current condition of Mill Creek. Subsequent decisions will be made regarding implementation approach, follow up of additional implementation and implementation in the non-priority subwatersheds.

**Consideration for 303d Delisting:** Mill Creek will be evaluated for delisting under Section 303d, based on the monitoring data over the period 2004-2008. Therefore, the decision for delisting will come about in the preparation of the 2008 303d list. Should modifications be made to the applicable nutrient criterion during the ten year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

**Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process:** Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2002 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in *Kansas Water Plan* implementation decisions under the State Water Planning Process after Fiscal Year 2004.

Approved January 26, 2000.